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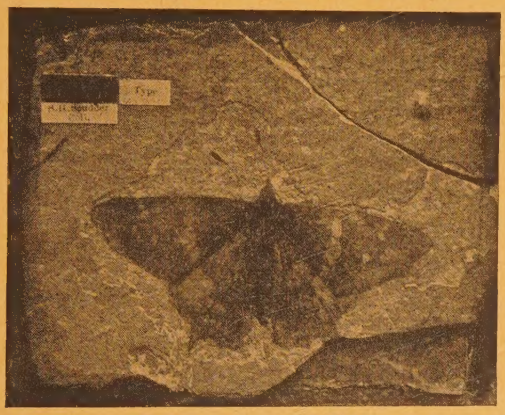

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PSYCHE

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A EUROPEAN TERMITE *RETICULOTERMES LUCIFUGUS* ROSSI IN THE VICINITY OF BOSTON.

By Robert James Dobson.
Bussey Institution, Harvard University.

In early May of the present year (1918) I was collecting termites in the vicinity of Boston in order to carry out some experiments at the Bussey Institution. Only one species of termites has been known to occur in this part of the country north of New Jersey, viz., *Reticulotermes flavipes* Kollar. I was surprised therefore during these collecting trips to find a few colonies of *R. lucifugus*, one of the common European termites of the Mediterranean region. This species has not been found in North America before, though at least two of our Western species have been confused with it. One of these occurs in California and another in Texas and also in Kansas.

There are not yet sufficient data on which to base a theory of its occurrence here. It wou'd be less remarkable had it been found further south where the climate differs less from that of its home in Southern Europe. The fact that it has not appeared in earlier collections would indicate that it is not widely distributed, and it is entirely possible that it has been accidentally introduced from Europe. Kellogg[1] records an instance of scores of termites of this species being found in the boards of some packing cases received at Stanford University from Germany.

The size of the colonies I have found, and the fact that one of them at least was headed by a large queen give evidence that they have been here for some years. On a wooded hillside in the outskirts of Boston where I found what appear to be several distinct colonies of *R. lucifugus* the species occurs side by side with *R. flavipes* and in approximately the same abundance. I have found the galleries of the two species within a few inches of each other.

[1]Kellogg, Vernon L., American Insects, 1908, p. 108.

The various forms in the colony are in general somewhat smaller than the corresponding forms in a colony of *R. flavipes*, and the winged adults are readily distinguished from those of *R. flavipes* by the deeper pigmentation of the wings and the proximity of the ocelli to the compound eyes. Among the forms that I have obtained is a physogastric "true queen." The abdomen of this queen measures approximately three times the length of that of the winged adults at swarming time. "True queens" in this species have apparently been difficult to find in Europe, so much so that Grassi concluded they never occur in nature at the head of colonies, their place always being taken by "complementary" or "substitute" royal forms. In more recent years however a few have been recorded.

The habits of *R. lucifugus* have been described in some detail by several authors, notably Lespes,[1] Grassi and Sandias[2] and Feytaud.[3] I will add here only the following brief notes on the dates of molting and flying of the winged sexual forms. On warm hillsides at Forest Hills and Stony Brook Reservation, nymphs of *R. flavipes* were found molting into winged adults in large numbers from May 5 to May 10, and were seen emerging from the colonies and flying on May 15, 17, and 19. The corresponding nymphs of *R. lucifugus* were molting in numbers to the adult state nearly a month later, May 30 to June 5, and were found flying as late as June 30. The flying of the latter was probably somewhat delayed by the prolonged cold weather in June. In 1917 *R. flavipes* swarmed in the early part of June in the colonies I was observing at Forest Hills. This corresponds with the backwardness of the season in that year. A typical swarm was witnessed on June 8.

The development to the adult state is apparently accomplished in *R. flavipes* as early in the spring as the weather will permit. The nymphs reach the last nymphal instar in the late summer or fall of the previous year and are to be found in abundance as early as the termites appear in the spring, the first of April at Forest Hills this year. At this time they keep to the outlying parts of

[1] Recherches sur l'organisation et les moeurs du Termite lucifuge. (1856) Ann. Sci. Nat. Zoöl., 4 série, t. 5.

[2] The constitution and development of the society of termites; observations of their habits; with appendices on the parasitic protozoa of Termitidæ and on the Embiidæ, (1893–4) translated by W. F. H. Blandford, Quat. Jour. Micros. Sci., vols. 39 and 40, new series. (1896–7).

[3] Contribution à l'étude du termite lucifuge. (1912) Archives d'anat. microsc., t. 13.

the nest apparently to get the benefit of the warmth from the sun to hasten their development. This would appear to be the case also with *R. lucifugus* with the one exception that they do not reach the last nymphal instar in the previous season. I was impressed with the fact that early in May (May 11–15, 1918) when in the colonies of *R. flavipes* the nymphs of the winged adults had just passed through their final molt (see above) the corresponding nymphs in *R. lucifugus* colonies on the same hillside were molting into the last nymphal instar and did not pass through their final molt until some three weeks later. This difference is evidently correlated with the fact that the adults of the latter species fly later than those of the former. It will be interesting to know whether the same difference obtains between *R. flavipes* and *R. virginicus* in Virginia where Snyder finds the latter swarming a month later than the former.

I wish to express my indebtedness to Mr. Nathan Banks who identified my specimens as belonging to the species *R. lucifugus*.

EMPOASCA MALI LeB. ATTACKS MAN.

By George G. Becker,
Agricultural Experiment Station, Fayetteville, Arkansas.

On June 4, 1918, I was pricked several times on the arm by some leaf-hoppers which Mr. W. D. Gibson determined for me as *Empoasca mali* LeB. These insects were attracted to the light under which I was studying. The sting of these insects was very insignificant. I should say not more than half so severe as a mosquito bite. There was no swelling, irritation or other after effects. It seemed that this Jassid did not do much more than merely prick the skin. On being disturbed, the leaf-hoppers which I observed moved off a little distance and again inserted their beaks in my arm.

NOTES ON THE SPECIES OF THE GENUS DIOCTRIA.

By Charles W. Johnson,
Boston Society of Natural History.

On a window of the Boston Society of Natural History, I obtained, June 28, 1916, a specimen of Dioctria, but being unable to identify it at the time it was set aside to await more material. On July 6, 1917, while walking along Rawson Road, Aspinwall Hill, Brookline, Mass., I caught four specimens of the same species—two males and two females. After a careful study and comparison with specimens in my collection from Lyndhurst, New Forest, England (♂ ♀) determined by E. E. Austin, I can only refer it to *Dioctria baumhaueri* Meigen. Wishing to see if the species was still to be found, I visited the place again this year (July 4) and captured five males and four females.

The sudden appearance and apparently restricted distribution of a species after so many years of careful collecting in the vicinity of Boston, would indicate a comparatively recent introduction, possibly on the root of some plants, many of which have in the past been imported. The species can be distinguished by the following diagnosis.

Dioctria baumhaueri Meigen.

Face black with silvery white tomentum, mystax white, front and vertex black, shining, antennæ black, third joint about as long as the first and second together. Thorax with a sparse yellow tomentum having two narrow lines of black, a transverse band of white tomentum on the pleura extends to the front coxæ, also with irregular patches above the middle and posterior coxæ, all the coxæ with long white hairs below. Abdomen black, shining. Front and middle legs yellow, a line on the upper side of the femora, tips of the tibiæ and tarsi black, posterior legs black, a spot on the under side of the femora at the base, and the base and tip of tibiæ yellow. Halteres light yellow, wings hyaline. Length, 9–10 mm.

In Psyche, vol. 24, p. 117, 1917, Mr. Nathan Banks described several new species, some of which were formerly confused with *Dioctria albius* Walker, but readily separated by the male genitalia. In going over my collection in connection with this paper, I have

noted a more extended distribution of some of the species and also the fact that two of the names used are preoccupied. In calling Mr. Banks' attention to this he said that he did not have access to the catalogues at the time and desired me to correct these in connection with my notes.

Dioctria brevis Banks.

This species has been taken by the writer at Mt. Tom, Mass., July 14, 1905; Delaware Water Gap, N. J., July 11, 1898, and Aquia Creek, Va., May 24, 1896.

Dioctria banksi nom. nov.

D. longicornis Banks, PSYCHE, XXIV, 118, 1917, not Meigen, 1820. Four specimens of this species were collected near Long Branch, N. J., June 9, 1913. A specimen from Philadelphia, Pa., (June 22, 1893), is also in my collection.

Dioctria sackeni Williston.

A specimen of what is undoubtedly the female of this species was taken by the writer near Ricketts, North Mt., Pa., June 9, 1898, at the same time and place that a male was also captured. It has the bright yellow tomentum of the face, front and thorax, and the yellow legs of the male, but the wings are uniformly hyaline with a slight yellowish tinge near the base.

Dioctria media Banks.

A single specimen of this species from Seattle, Wash., collected years ago by the late Professor O. B. Johnson is in my collection.

Dioctria henshawi nom. nov.

D. flavipes Banks, PSYCHE, XXIV, 119, 1917, not Meigen, 1804. The name *flavipes* being preoccupied in this genus, the species is dedicated to Mr. Samuel Henshaw who collected the type at Yakima, Wash., July 2, 1882.

MYRMECOPHILOUS INSECTS FROM CUBA.

By William M. Mann,
Bureau of Entomology, Washington, D. C.

A collection of myrmecophilous insects that I made in Cuba the past winter, though very small, includes several genera new to the fauna of that island. In addition to records of these, I have described a Clavigerid beetle, *Fustiger schwarzi*, sp. nov., from a specimen in the U. S. National Museum.

Orthoptera.

Myrmecophila americana Sauss.

Guantanamo; Cienfuegos.

I am following Schimmer (Zeitschr. wiss. Zoöl. Bd. xciii. Heft. 3, p. 432) in considering this to be the same as *M. prenolepidis* Wasm.

My specimens were taken with *Prenolepis longicornis* Latr., the usual host. Besides its wide-spread distribution *M. americana* is interesting in that it lives only with this one species of ant, instead of taking up with almost any species, like our North American forms do. Assmuth (Zeitschr. f. wiss. Insektenbiol. 1907, Bd. iii, p. 363–364) has given an interesting account of the moving of a colony of the host ant to a new nesting site. The crickets and the beetle, *Coluocera maderæ* Woll. accompanied the ant column and entered the new nest with it. Myrmecophila does not always leave a nest when the hosts do, for specimens are frequently found in formicaries that have been deserted by the ants. In connection with the local distribution of Myrmecophila the following note is of interest.

On Plummer's Island, Maryland, in an open-air insectary, several cigar boxes used as breeding cages had been left for some time on a high shelf. When I looked into these I found them tenanted by populous colonies of *Crematogaster lineolata* Say, and with these, several adults of *Myrmecophila pergandei* Scud. The crickets had either climbed the five feet of po'e that held the shelves, or they had been transported by the ants, perhaps as immature phases. I think the latter more probable, chiefly because of some observations made on a related species of cricket on various islands in the Southwest Pacific. I found the cricket abundant,

and often on small isolated and deserted coral islands where one wondered how even the host ant could have reached and established itself.

HEMIPTERA.

Rhitidoporus indentatus Uhler.

Mina Carlota, Trinidad Mts.

Two specimens taken in a flourishing colony of *Solenopsis geminata* Fabr. indicate that this species resembles some of our North American species of Thyrecoris in having myrmecophilous tendencies.

COLEOPTERA.

Fustiger schwarzi sp. nov.

Length, 1.50 mm. Color reddish brown, the elytra somewhat lighter than the rest. Head nearly three times as long as broad; as broad in front as behind; sides subparallel; front transversely impressed between the eyes; occipital corners obtusely angulate, border feebly concave. Eyes small and convex, located at middle of sides of head. Antennæ one and one-fourth times as long as head; terminal joint slightly concave at middle, thickened at apical half, the end broadly rounded. Prothorax as broad as long, with a large median fovea along basal half; sides evenly convex. Elytra taken together about as long as broad, broadest behind, with narrowly rounded humeral angles and convex sides. Abdomen very deeply impressed transversely at base, tuberculate on either side and with a rather scant brush of yellow hairs. First segment margined at sides for entire length. Propygidium nearly four times as broad as long.

Shining. Head, antennæ and basal third of elytra foveolately punctate. Abdomen minutely punctate above, the ventral surface with abundant rather coarse punctures, fine recumbent white hairs moderately abundant everywhere except on abdomen.

Described from a unique female taken at Cayamas, Cuba, January 2, 1904, by E. A. Schwarz. It was in the nest of an ant of which no specimens were preserved.

Type No. 21569. U. S. N. M.

Coluocera maderæ Woll.

Cienfuegos.

Several specimens from one nest of *Prenolepis longicornis* Latr.

HYMENOPTERA.

Orasema minutissima Howard.

Mina Carlota, Trinidad Mts.

Several pupæ and adults were found in a hollow twig, with a colony of *Wasmannia auropunctata* Roger.

Acanthopria crassicornis Ashm.

Santiago de Cuba.

A single specimen taken in a nest of *Cyphomyrmex rimosus* Spin. var. *minutus* Mayr. agrees closely with the type from Grenada.

DISTRIBUTIONAL NOTES ON NEW ENGLAND ODONATA.

PART II.[1]

BY R. HEBER HOWE, JR.,
Thoreau Museum, Concord, Massachusetts.

The following additional records for Vermont are based on another small collection sent me by Mr. D. Lewis Dutton from Brandon. The specimens were captured in July, 1916.

Lestes unguiculatus Hagen; new to Vermont.
Lestes uncatus Kirby; new to Vermont.
Argia violacea (Hagen); new to Vermont.
Nehalennia irene (Hagen); new to Vermont.
Amphiagrion saucium (Burm.); new to Vermont.
Enallagma hageni (Walsh); new to Vermont.
Æshna verticalis (Hagen); new to Vermont.
Libellula pulchella Drury; new to Vermont.

The following record is new to Concord, Mass., bringing the known species from this township to sixty-eight.

Argia mœsta Hagen. Female taken August 15, 1916, and previously overlooked.

[1] The figures in the chart of the Zygoptera published with this paper originally appeared in the author's manual of Odonata of New England, Parts I–II (Memoir of the Thoreau Museum of Natural History, II; 1–23, 1917. They are republished dichotomously here, because of numerous requests that they be available in the present form, and where they will reach more students of Odonata through the larger circulation of Psyche.

Pictorial Key of Genera of Zygoptera

ODONATA

Zygoptera: Damsel Flies

Wings *closed* when alighted.

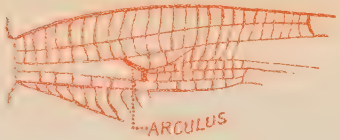
Eyes *widely* separated, by *more* than the full width of an eye.

Agrionidae

Five or more antecubitals. Wings *not* stalked.

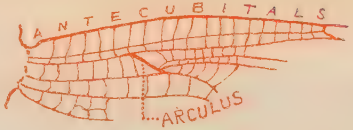
Agrioninae

Agrion



Arculus *basal*

Hetaerina



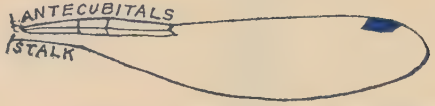
Arculus *straight*.

Anisoptera: Dragon Flies

Wings *open* when alighted.

Eyes *approximate*, separated by *less* than half the width of an eye.
(See later key to Anisoptera: Dragon Flies.)

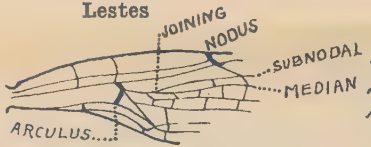
Coenagrionidae



Two (rarely three) antecubitals. Wings *stalked*.

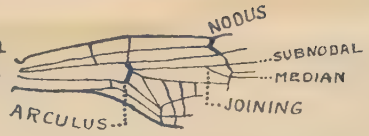
Lestinae

Lestes



Subnodal and median veins *joining nearer* the *arculus* than the *nodus*.

Coenagrioninae



Subnodal and median veins *joining nearer* the *nodus* than the *arculus*.

Argia

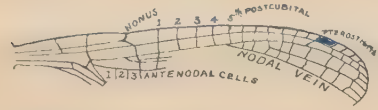
Hairs on tibia *twice* as long as the *spaces* between the hairs.

Hairs on tibia *never* twice as long as the *spaces* between the hairs.

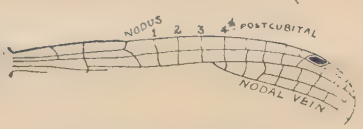
Pale spots (rarely connected by pale narrow line) on top of *head*.

No pale spots on top of *head*.

Enallagma



Nodal vein of fore-wing *arising near* or *beyond 5th postcubital*.



Nodal vein of fore-wing *arising not* beyond *4th postcubital*.

Ischnura

Pterostigma of *male touching* the *costa* on *fore* wings.
♀'s with *more* than 7 postcubitals.

Anomalagrion

Pterostigma of *male not touching* the costa of *fore* wings.
♀'s with *less* than 7 postcubitals.

Nehalennia

♂ and ♀ *bronze green* above, abdomen *slender*.

Amphiagrion

♂ and ♀ *red* and *black* above, abdomen *stout*.

Chromagrion

♂ and ♀ *blue* and *black* above.

Color pattern of thorax and basé of abdomen of ♂'s as seen from above, also 3rd segment of ♀'s abdomen showing *relative* diameter drawn to scale.

The following records were found represented by specimens in the collection of the Museum of Comparative Zoölogy, Cambridge, Mass., and are here recorded with the permission of Dr. Samuel Henshaw.

Lestes unguiculatus, White Mountains; new to New Hampshire.
Enallagma aspersum (Hagen), Norway, Me.; new to Maine.
Ischnura posita (Hagen), White Mountains; new to New Hampshire.
Ischnura ramburii Selys, Canton (Mass.?); new to Massachusetts.

The following records I am permitted to record by Dr. R. P. Currie based on material in the U. S. National Museum.

Lestes eurinus Say, Burchard's pond, Fairfield Co., Conn.; new to the State.
Lestes congener Hagen, Franconia, N. H.; new to State.
Enallagma aspersum Devil's Garden, Fairfield Co., Conn.; new to State.
154. *Boyeria grafiana* Will., Cummington, Mass., July 5, 1889, collected by F. Knab.; new to New England.
155. *Tetragoneuria costalis* Selys, Manchester, Me., June 9, 1898, collected by Wadsworth; new to New England.
Tramea carolina (Linn.), Fairfield Co., Conn.; new to State (see ibid., Part I).
Sympetrum costiferum (Hagen), Franconia, N. H.; new to State.
Celithemis eponina (Drury), Litchfield Co., Conn.; new to State.
Perithemis domitia tenera (Say), Fairfield Co., Conn.; new to State.
Erythemis simplicicollis (Say), Fairfield Co., Conn.; new to State.
Pachydiplax longipennis (Burm.), Fairfield Co., Conn.; new to State (see ibid., Part I).

On January 3, 1917, through the kindness of Dr. Frank E. Lutz of the American Museum of Natural History, New York City, I was able to examine the collection of Odonata for New England material. I was also introduced by Dr. Lutz to Mr. Lewis B. Woodruff who had collected all but four of the New England dragon-flies found in the Museum's collection. Later I visited Mr. Woodruff who kindly permits me to publish the following records which were gleaned in an examination of his private col-

lection. Mr. Woodruff's collecting in New England has practically all been done at Litchfield, Conn., and he adds fifty species to the State list as given by Dr. Calvert, and one new species to New England.

Agrion amatum (Hagen) Litchfield, June 29, to July 14. The capture of this very rare species, new to Connecticut, was recorded by Mr. Woodruff in the Jour. N. Y. Ent. Soc., 22: 155, 1914.

Agrion æquabile (Say) Litchfield; new to the State (recorded ibid. 155).

Agrion maculatum Litchfield, with the above records from the Boston Society of Natural History; new to the State.

Lestes congener Litchfield; new to the State.

Lestes disjunctus Litchfield; new to the State.

Lestes rectangularis Litchfield; new to the State.

Lestes vigilax Litchfield; new to the State.

Argia mæsta Litchfield; new to the State (recorded ibid. 157).

Chromagrion conditum (Hagen) Need., as *putrida* (Hagen) Litchfield; new to the State (recorded ibid. 157).

Nehalennia irene Litchfield; new to the State.

Enallagma ebrium Litchfield; new to the State (recorded ibid. 157).

Enallagma civile Litchfield; new to the State.

Enallagma exsulans Litchfield and West Hartford; new to the State (recorded ibid. 157).

Enallagma signatum West Hartford and Block Island, R. I.; new to both States.

156. *Enallagma carunculatum* Morse Litchfield; new to New England.

Ischnura posita Litchfield; new to the State.

Hagenius brevistylus Litchfield; new to the State.

Gomphus johannus Need. Litchfield; new to the State. This was recorded by Mr. Woodruff in the Jour. N. Y. Ent. Soc., 22: 61–63, 157, 1914).

Gomphus albistylus (Hagen) Need. Litchfield; new to the State (recorded ibid. 22:157).

Gomphus brevis Hagen Litchfield; new to the State (recorded ibid. 22:157).

Gomphus sordidus Hagen Litchfield; new to the State.

Gomphus spicatus Litchfield; new to the State.
Dromogomphus spinosus Litchfield and West Hartford; new to the State.
Cordulegaster diastatops Litchfield; new to the State (recorded ibid. 22:156).
Anax junius Litchfield; new to the State.
Æshna clepsydra Litchfield; new to the State.
Æshna canadensis Litchfield; new to the State.
Æshna umbrosa Litchfield; new to the State.
Æshna verticalis Litchfield; new to the State.
Æshna tuberculifera Litchfield; new to the State, also in the Museum, collected at Provincetown, Mass., by J. L. Sabriskie.
Basiæshna janata Litchfield; new to the State.
Boyeria vinosa Litchfield; new to the State.
Didymops transversa Litchfield; new to the State.
Tetragoneuria cynosura Litchfield; new to the State.
Tetragoneuria cynosura var *simulans* Litchfield; new to the State.
Tetragoneuria spinigera Litchfield; new to the State.
Helocordulia uhleri Litchfield; new to the State.
Somatochlora tenebrosa (Say) Selys Litchfield; new to the State.
Cordulia shurtleffi Litchfield; new to the State.
Dorocordulia libera Litchfield; new to the State.
Libellula pulchella Litchfield; new to the State.
Libellula luctuosa Litchfield; new to the State.
Sympetrum rubicundulum Litchfield; new to the State.
Sympetrum vicinum Litchfield; new to the State.
Sympetrum costiferum Litchfield; new to the State.
Leucorrhinia frigida Litchfield; new to the State (recorded ibid. 22:158).
Leucorrhinia intacta Litchfield; new to the State.
Celithemis elisa Litchfield and New Hartford; new to the State.
Celithemis eponina, Block Island, R. I.; new to the State.
Perithemis tenera Litchfield; new to the State (see above).

Prof. A. P. Morse of Wellesley College, Wellesley, Mass., has kindly sent me the following records with permission to publish the same in this paper:

Lestes inæqualis, Sherborn, Mass.; new to the State (see ibid., Part I).

Enallagma exsulans, Sherborn, Dover, and Medfield, Mass.; new to the State with the above records.
Enallagma ebrium, Brattleboro, Vt.; new to the State.
Amphiagrion saucium, Montgomery, Vt.; new to the State (see above).
Cordulegaster diastatops, Jay and Troy, Conn.; new to the State with Mr. Woodruff's records.
Boyeria vinosa, Wolcott, Vt., July 23; new to the State.
Libellula auripennis, Niantic, Conn., August 8; new to the State.
Sympetrum rubicundulum, Newport, Vt.; new to the State (see ibid., Part I).
Sympetrum semicinctum, North Haven, Conn.; new to the State.
Erythrodiplax berenice, Niantic and Stamford, Conn.; new to the State (see ibid., Part I).

The following record is represented by a specimen in the Boston Society of Natural History:

Erythrodiplax berenice (Drury), Barrington, L. I., June; new to the State.
Species known to Maine = 99.
Species known to New Hampshire = 97.
Species known to Vermont = 26.
Species known to Massachusetts = 123.
Species known to Rhode Island = 27.
Species known to Connecticut = 72.

SOME VARIATIONS IN THE GENUS VANESSA (PYRAMEIS.)

By Fordyce Grinnell, Jr.

The following notes on some very significant variations of the species of *Vanessa* (*Pyrameis*), originated from a series found in the collection of Mr. James E. Cottle of San Francisco. Other specimens, also representing the same variations, are in the collections of Mr. J. D. Graves of Oakland, Mr. J. C. Huguenin of San Francisco, and a few from the writer's collection have been deposited with the series in Mr. Cottle's collection. The illustration represents those in Mr. Cottle's collection and captured by him.

Vanessa (Pyrameis) caryæ Hübner.

This species is well known in its typical form as figured by Holland, Wright, Letcher and Essig. Its range extends along the Pacific Coast from Vancouver and British Columbia to Chili, being especially abundant in California. It is recorded in Skinner's Catalogue from "Ariz., Nev., Utah," but I have seen no specimens from these regions, and do not know of any authentic records. Nor have I seen any specimens from the western coast of South America, where a knowledge of the variations would be of particular interest in the evolutionary study of the species. The species varies in size but there seems to be no correlation between the size and marking variation. The normal or typical *caryæ* seems to be characterized especially by the extent of the black markings of the primaries and the large submarginal black eye spots of the secondaries, only slightly pupilated with bluish scales, not white.

Vanessa caryæ var. **muelleri** Letcher.

This variation as described by Letcher (4) varies from the normal form of *caryæ*, which is the commonest, in the extension of the fulvous color of the basal portion of the forewings and the nearly complete elimination of the black markings in this area. The apical white spots develop into dashes extending towards the outer margin. The large fulvous spot or series of spots in the costo-apical black field is still present. There is an additional large fulvous patch or two patches (usually) just below the row of apical white spots. The black marginal band is connected with the costo-apical black area by a rather broad black area. On the secondaries the black encircled blue spots become white or bluish-white, and there is a slight extension of the black in the upper portion. The specimens figured by Essig are not this but belong to the following variation.

Of the typical *muelleri* variation I have seen specimens from the following localities:—LaFayette Square, San Francisco, August 1914 (Cottle); Los Angeles, July 1915 (Karl Skolfield); 18th Street Square, San Francisco, October 8, 1917 (Huguenin); San Francisco, October 17, 1917 (Huguenin).

Vanessa caryæ var. **intermedia** var. nov.

This intermediate variety between the typical *caryæ* and typical *muelleri* differs in having basal traces or remnants of the black

markings in the fulvous replacement of the forewings; and a broad black band on the upper half of the outer margin of the hindwings. It still keeps the row of black-encircled blue-centered eye spots on the hindwings. The larger fulvous spot below the apical row of white spots is large. The fulvous patch in the costo-apical black area is still present. I have before me three specimens from the following places:—Berkeley, August 3, 1917 (Graves); November 5, 1911 (Graves); San Francisco (Cottle); San Francisco, October 10, 1917 (Huguenin).

Vanessa caryæ var. **letcheri** var. nov.

The striking difference from *muelleri* lies in the *entire* disappearance of the fulvous spots or band of spots in the costo-apical black area, leaving a solid black, quadrangular area. The two fulvous patches below the apical row of white spots are much larger, and nearer the larger, basal fulvous area, leaving only a narrow black connection to the quadrangular black area and wider black outer margin. The basal portion of the hindwings is blacker than in *muelleri*. The following specimens have been examined:—Castella, Shasta Co., June 1913 (Cottle); Berkeley, July 20, 1917 (Graves); July 30, 1917 (Graves); Los Angeles, July 1915 (Harold Burkhardt); Los Angeles, July 1915 (Karl Skolfield); 18th Street Square, San Francisco, September 24, 1917; Oakland, September 4, 1917; October 9, September 17 (Huguenin).

In all these variations the black discal dash in the costal side of the large fulvous area of the primaries remain practically unchanged; all the other markings become more or less altered.

In 1898 the variety *letcheri* was apparently not known in collections and the variety *muelleri* was "very rare," but Letcher mentioned the fact that Mueller had some intergrades between *caryæ* and *muelleri* in two directions; one is like the one here named *intermedia*, and the other with the blue spots of the secondaries replaced by white and without any change in the primaries. The apical white spots are either blurred, smaller, or lengthened out in the direction of the apex, and indefinite. These remarkable and significant variations seem to be increasing and tending in the direction of *letcheri*. Letcher recorded the variations known to him as taken only in the fall, but they are now known to be found throughout the year.

GRINNELL—Variations in the Genus Vanessa.

As Letcher surmises, in the case of *muelleri*, this variation may be "an example of the evolution of a true variety time only will tell." At any rate since 1898 the variations have become more common, *letcheri* the commonest, and are very suggestive from an evolutionary standpoint. We must watch the behavior of these variations still more in future years.

Essig (1) figures two specimens of *letcheri* as *muelleri*. Here we have a series extending from typical *caryæ*, through *intermedia* and *muelleri* to *letcheri*, showing a progressive evolution. Mr Cottle took two other specimens of *caryæ* in Lafayette Square, San Francisco, showing an interesting variation, but they do not belong in the same category as the above variations. One of these has the primaries of the usual light coral red color, while the hindwings are of a light coral pink or a washed-out appearance. The other specimen has the usual color of all the wings replaced by a light flesh-pink (Ridgway).

Vanessa cardui Linn. var.

Expanse 66 mm. This very striking variation of a cosmopolitan butterfly bears a very close resemblance to *letcheri*, as can be seen, and is very nearly like that of *cardui* figured by Newman (5) from England. There is a submarginal row of comparatively large white spots on the primaries, the two middle ones being the largest; also a similar row of white spots on the secondaries which are of the same size. The outer ends of the veins of the hindwings are bordered wholly with black. And the middle region of the hindwings is of the same fulvous color as the ground color of *letcheri*.

Now *cardui* is a cosmopolitan butterfly while *carye* is restricted to the Pacific side of the two Americas, and the most restricted of all the *Vanessas* (*Pyrameis*); but here we have a form which occurs in *cardui* of the same pattern as the seemingly more recent one in *caryæ*. These sports, aberrations, or what is better to call them, variations of a different degree, are of more significance in the evolutionary history of species than seems to be generally supposed. We have here, probably, a good example of orthogenetic variation or a definitely directed evolution.

Vanessa atalanta Linn. var. edwardsi var. nov.

Expanse 56 mm. The wide band or series of quadrate spots across the primaries is an apricot-orange (Ridgway) instead of a

carnelian red as in typical *atalanta* and the costo-apical or subapical white patch of *atalanta* is a salmon-buff in this variety. There are four white apical spots. The outer margin of the hindwings are of an apricot-orange; the basal portion of the primaries and secondaries is of a bordeaux red (rusty red) instead of a deep purplish black as in *atalanta*. There is a submarginal row of black spots on the hindwings in the same position as those of *carye*. The underside more nearly resembles *atalanta*. In its characters this variation partakes of the aspects of both *carye* and *atalanta*. Henry Edwards (3) records a specimen of what he speaks of as a hybrid between *carye* and *atalanta*. The description of his specimen resembles mine very closely. The submarginal row of spots had white pupils while mine has none, except a very faint trace in two of them. Henry Edwards' specimen was raised by Dr. Behr from the larva from Lagunitas, Marin Co., July 1876; while Mr. Cottle's specimen was caught flying at Buchanan and Washington Streets, San Francisco, in August 1914. So there is quite a time interval in the capture of these two similar variations, but in a short distance geographically. This is a very interesting variation, which we are hardly justified in calling a hybrid, and undoubtedly has some evolutionary significance.

As an excuse or an explanation for naming these new variations it is well to say that it is particularly useful to know as much about the variations of a species as possible, especially now, when so much is being said of the order of evolution; whether it is indiscriminate or directed or whether it may follow both paths. It is only by the accumulation of definite data concerning variations that we can arrive at a correct idea of the order of evolution in a given species. It is the method we want to know, and there is no more intricate problem confronting us.

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2. *Wright, W. G.* The Butterflies of the West Coast, 1905, pp. 177–178, pl. XXII.

3. *Edwards, Henry.* Proc. California Acad. Sci. (Pacific Coast Lepidoptera), Vol. 7, 1877, pp. 171–172.

4. *Letcher, Beverly.* Variation of *Pyrameis caryæ* Hübner. Entom. News, IX, 2, p. 38, pl. III, Feb. 1898.

5. *Newman, Edward.* An Illustrated Natural History of British Butterflies and Moths. London, p. 64, fig. 17, var. 1.

Explanation of Plate.

1. *Vanessa carye* var.
2. *Vanessa carye* var.
3. *Vanessa atalanta* var. *edwardsi* n. var.
4. *Vanessa cardui* var.
5. *Vanessa carye* normal.
6. *Vanessa carye* var. *intermedia* var. nov.
7. *Vanessa carye* var. *muelleri* Letcher.
8. *Vanessa carye* var. *letcheri* n. var.

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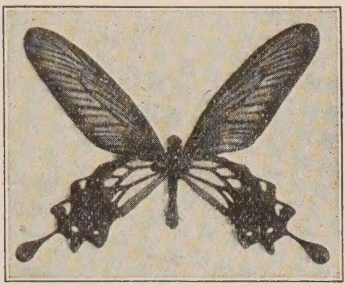

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